Human and computer interaction (1649)

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Prototype URL: https://1ked5a.axshare.com/#id=gcer9s (For apple watch), https://yuts61.axshare.com (For Phone).
Source: https://drive.google.com/drive/folders/1mceamCUVVc_xShQTEHDUev9Sy4yQank2?usp=sharing

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1 Introduction

This document is used to document the development of the ski tracking application. The project aims to increase the understanding about the aspect of human and computer interaction. Which is why the report will focus on the interaction of the user and the application, instead of its code.

During the report many design concepts will be brought up, which also include their source, their implementation and the reason why they are chosen. Like the name indicated, humans are a crucial element in this project, so few human behavioural concepts will also be bringed up.

The document will separate into multiple parts including background, design process, prototype, research study and conclusion. Background is the part where the basic design concept is collected. Design process is where the idea of the application is born. Prototype is the place when demonstrating the core of the application. Research study is where the prototype is bringed to the test.

Finally there will be a conclusion part which is used to evaluate the project in whole. And there is also a reference part to list out all the sources of the borrowed concept.

2 Background

Focusing on the Human Computer Interaction, or HCI, aspect, the product won't involve code. Instead the product will be demonstrated using Axure RP, a famous UX development tool that allows users to make a realistic and functional prototype.

2.1 Interaction design research

One of the basic steps to create something is define the base requirements. There are many ways to achieve this, but in this case the easiest way is to learn this from other apps that already exist in the market. The one being chosen is Ski Tracks, one of the oldest and well used skier apps.

Figure 1 Ski tracks interface(Courchevel, 2022)

2.1.1 Functional requirements

From the app, there is multiple information that can be considered to be crucial for a ski app, include:

- Login: As a ski track application, it is important to let the user personalise their experience. This functionality is the first step to make such a thing possible. Not that this also provides the user a certain level of security over the information they share.
- Personal tracker: We can provide users all the information of their destination, but in the end, the user is the only person that decides what kind of experience they have. By allowing users to record their own experience of the place, we aid them in the process of deciding their next destination. Depending on some point of view, this is the most important part.
- Environment information: Including many elements such as max speed, distance and ski time,... This type of information is crucial to give users a first impression of the experience that they are about to have. Depending on each user there will be a different preference, that is while it is necessary to allow users to personalise their experience.
- Weather information: This is what Ski Tracks doesn't have, but for a ski resort this kind of information is crucial. The reason is simple: skiing depends on the snow and snow in nature depending on the weather. On the other hand, the weather also directly affects the user experience and safety.
- Route information: One of the most important parts of the Ski application is providing sufficient information for users to make their strategy, thus the route information is crucial for a successful ski app.

2.1.2 Non-functional requirements

Fundamentally, the Ski Tracks app has provided a good base for a ski app. But this is not the main reason why it is chosen. Ski Tracks are good as learning material for HCI because, with some non-functional requirements, it can be even better.

- Information highline: Humans can't see too much information at the same time. The way environment information displays in Ski Tracks makes it hard to tell what the page tries to say at first glance.
- Involvement: There doesn't seem to be any difference between the current Ski Tracks app and the app that only displays pictures. This causes the app to have a huge weakness in getting user involvement and lead to a downgrade in message transmission.
- User friendly: One of the requirements of the good app is that it is good to start and that is what Ski Trackers lack. The information displayed on the app focuses too much on the professional aspect. For the beginner, it is hard to say whether they will have a good experience from this data.
- Human element: These elements include many things, the colour, the way description of the information, and many more. But they all share one purpose, to make the user experience become more natural and fluent. For example if the Ski Tracks have a better colour distribution, the information would be better to read.

2.2 Interaction design theory

To understand the design, there is some concept and theory that needs to be made clear. This includes basic concepts about the interaction design, the impact of human cognition in HCI design, persuasive design and emotional interaction.

2.3 Interaction design

Interaction design is one of the most important aspects of a good product. Though this is not simple, after all it is not so hard to make a product that allows the user to complete a task, but it is not easy to make that experience enjoyable.

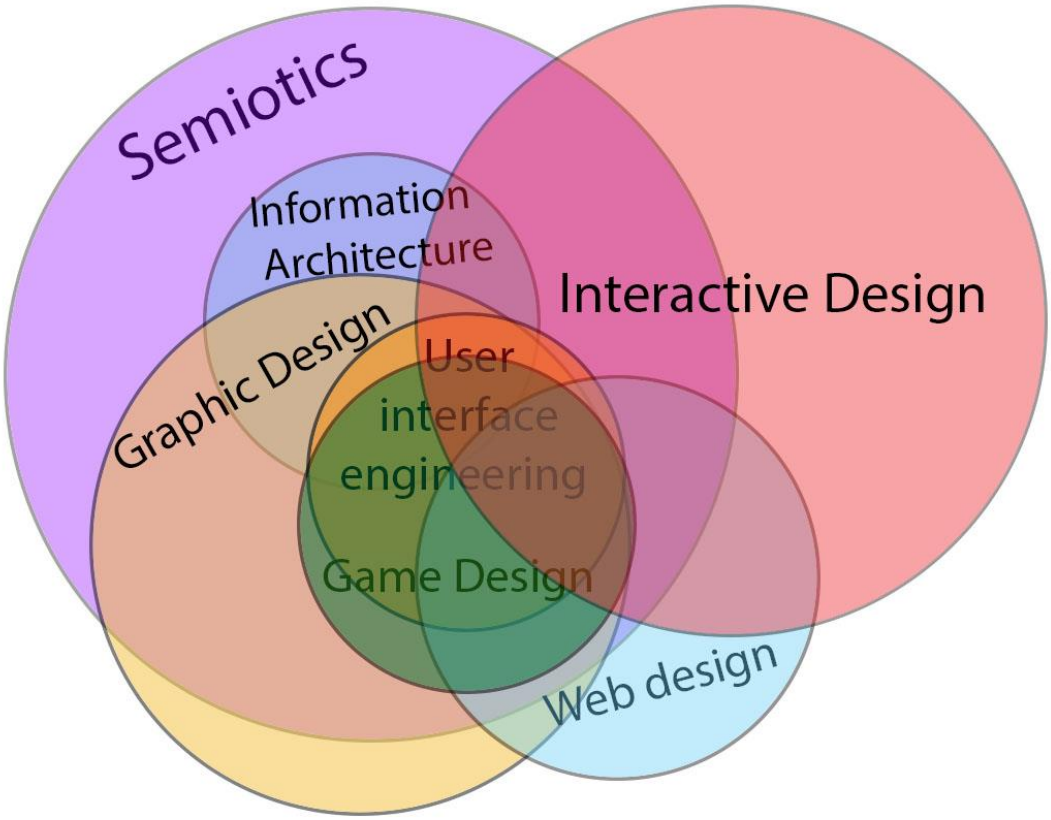


Figure 2 Interaction design(Wikipedia, 2012)

To be qualified at a good interaction design, functionality is not the only thing demanded. There is no good interaction design without concern about usability. By definition, usability can be considered at the degree to which something is easy to use. According to the book, Interaction Design, usability can be understanded through broken into multiple goal:"

- Effective to use (effectiveness)
- Efficient to use (efficiency)
- Safe to use (safety)
- Having good utility (utility)
- Easy to learn (learnability)
- Easy to remember how to use (memorability)."(Preece, Roger, Sharp, 2015)

In the upcoming project, the usability element will be implemented into multiple aspects of the design. One of the most well regarded goals would be how to make the product easy to use. This concern is not limited to the task to task activity, but also about how easy for the user to approach, and many aspects.

2.4 Cognition

To understand the reason why this topic is brought up, first we need to understand the concept of cognition. According to the dictionary, cognition is "the mental action or process of acquiring knowledge and understanding through thought, experience, and the senses."(Lexico, 2020)

Simply speaking, cognition is the core and base for every human action, including interacting with the technology. It is fair to say that cognition is the thing that has a final say whether the design is good or not.

Though despite its importance, cognition is a very big field, that is why this project only focuses on a few parts of human cognition. First and foremost is attention, to achieve this there are many ways, colour, sound, light, image, though maybe one of the easiest things to implement is coming from the research of psychologist Donald Broadbent. In Broadbent' filter model of attention, he has said that there is a filter inside of the human brain, and it contributes vastly in how humans deal with a huge amount of information coming from the world. For detail "This filter functions together with a buffer, and enables the subject to handle two kinds of stimuli presented at the same time. One of the inputs is allowed through the filter, while the other waits in the buffer for later processing. The filter prevents the overloading of the limited-capacity mechanism located beyond the filter, which is the short-term memory." (Donald Broadbent, 1987)

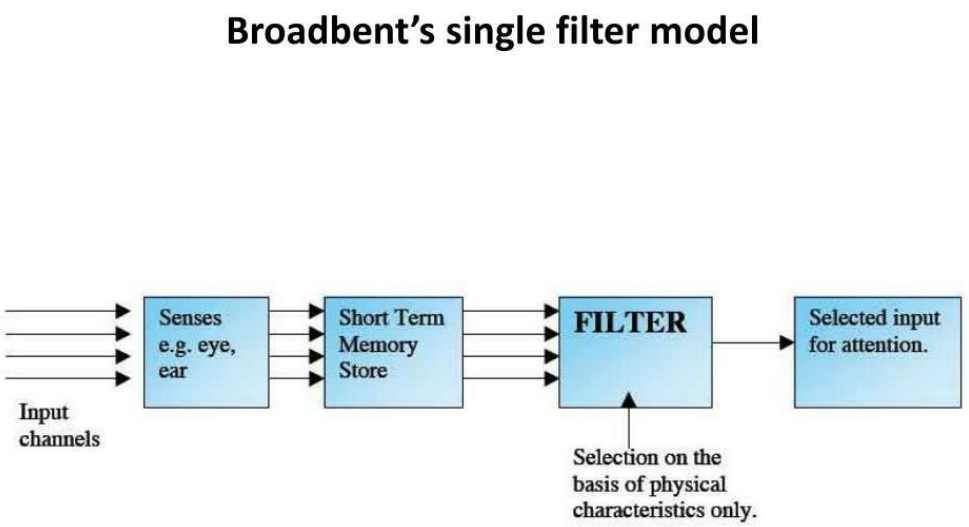


Figure 3 Broadbent's single filter model(Grover Kamden, 2012)

Attention may be one of the most important parts, but it is not the only thing to learn from cognition, perception and recognition is also one of the influential parts. The interaction should make the information perceptible and recognizable. And this will also be shown inside of the product.

2.5 Persuasive design and emotional interaction

In real life just because the product is functional doesn't mean that people will use them. For example in our case, even when a ski app is free and running, it doesn't mean that the user will choose them out of multiple apps that already exist on the market. This is why we need a product to be persuasive.

Figure 4 Persuasive design(Udit Khandelwal, 2016)

To step further into the topic we need to first look into the concept of PET design. Stand for persuasiveness, emotion and trust, using psychological and social theory, this model aims to influence human behaviour and increase user engagement.

One of the ways this element appears inside of the project is through the display of the grading system. For example, by seeing the overall stars of the ski resort, the user has a higher chance to choose the resort as their destination, as people have a tendency to follow the mass.

On the other hand, we have emotional interaction, an aspect that in the first glance doesn't seem to relate much to the current project. But this impression can easily change just through two examples that can easily be seen in real life.

The first example is a student who gets sleepy during the lecture. Surprisingly, not all of these students are bad students, sometimes the situation is not in their control, especially when the lecture is demonstrated in monotone. The second example comes from the case that humans likely remember speech if they consider them to be heartful.

Two examples, both about conveying information, and they come out with completely different outcomes. This outcome, lay in one element, the emotion that the listener feels from the situation. The emotion in this case, defines how much engagement people gave.

There are many different ways to implement this, human emotion is very easy to be influenced by the environment, symbols and symbols around them. For example:

Figure 5 Smiling icon(Google, 2013)

The image above gives out a happy air. If letting this go with the sunny weather forecast, users will be more likely to remember that day as a good day. This will make users choose this day as the day for family activity.

3 Design process

3.1 Concept Design

To understand the design of the ski app, let's first look into the diagram below.

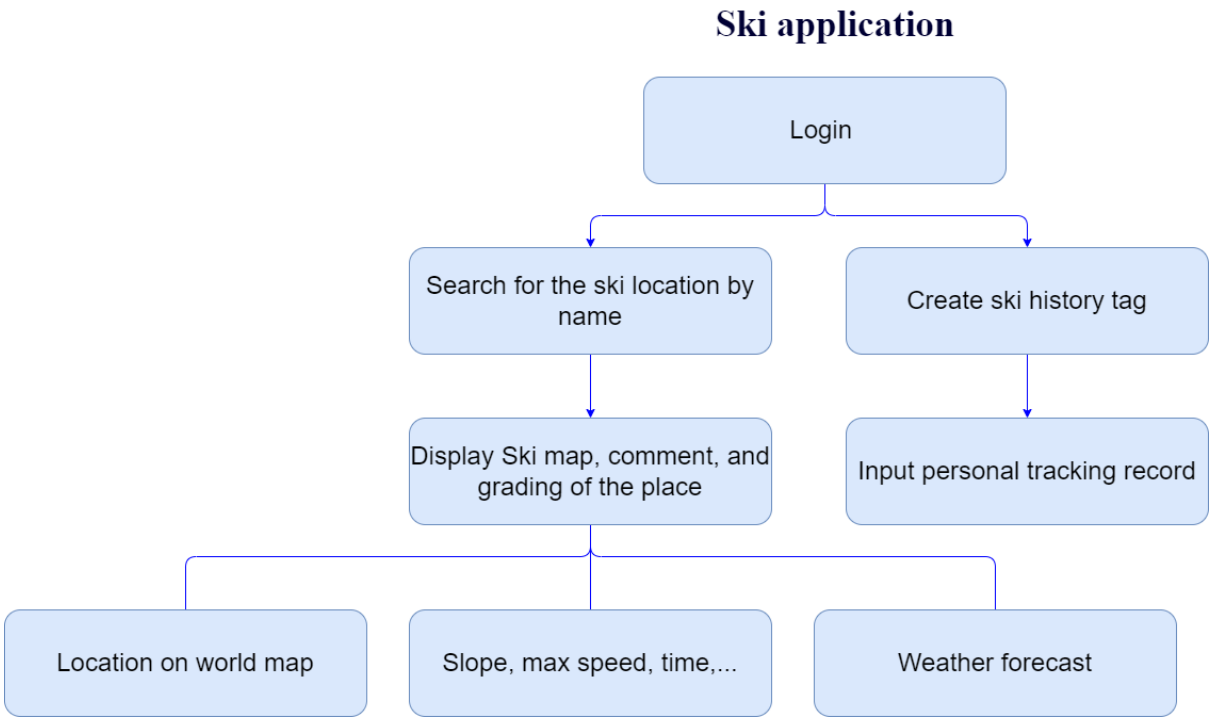


Figure 6 Ski application

The diagram has shown the idea of the whole product. When users first come to the app, they will be greeted with the welcome text, which is an implementation of the emotional interaction, and a simple search bar, which ensures that the user won't be overwhelmed with unnecessary information. The moment the user inserts their location is when the application really begins.

If there is information about the ski location, they will be shown on the screen, but for the first page, the information won't focus on the details of the ski location. Instead, following the rules of persuasion and cognition, the information aims to answer one of the user's big

questions: will they have a good time. This is achieved through the display of grading, comment and ski map.

The above design is aimed mostly on the conventional aspect, which is more about new user friendliness, but this doesn't mean it conflicts with the professional skier's demand. Come to the other element that only becomes viewable after the user input their destination. Each page may be different but they follow the same interaction rule, at first everything needs to appear simple.

This means that only when the data is chosen by the user, the further extra data will appear. With this user won't be easily overwhelmed by the information and everyone can easily focus on the information they need.

On the other hand, users can record their track. This record will be managed in the form of a tag which can be created freely by the user. Through the tag user will come to their tracking page, where they can input their personal track like average speed, cost and their ski distance.

3.2 Five dimension of interaction design

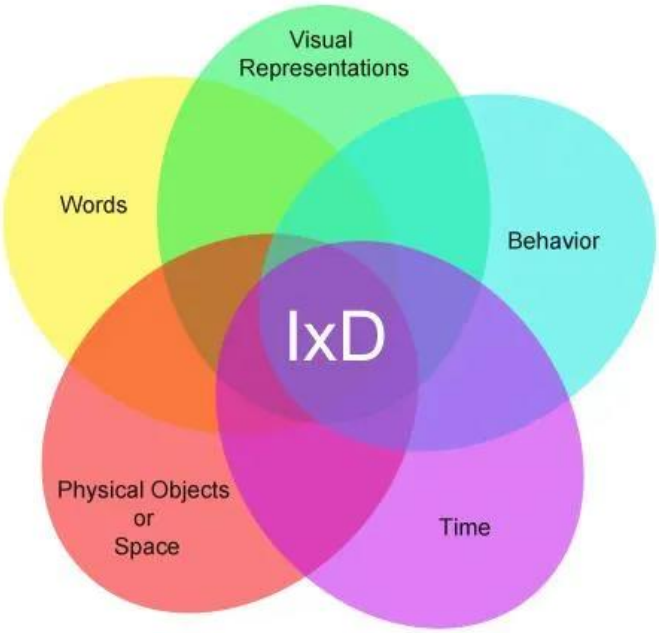


Figure 7 Five dimension of interaction design(Interaction design, 2015)

The project's also built by using the concept of five dimensions of interaction design, first introduced in Designing Interaction. In the book, Crampton Smith introduced four dimensions of interaction design, later Kevin Silver added behaviours, turning the number of dimensions into five. "

- Words: This dimension defines interactions, words are the element that users interact with.
- Visual representation: Visual representations are the elements of an interface that the user perceives; these may include but are not limited to "typography, diagrams, icons, and other graphics".
- Physical object or space: This dimension defines the objects or space "with which or within which users interact".

- Time: The time during which the user interacts with the interface. An example of this includes "content that changes over time such as sound, video or animation".
- Behaviours: Behaviour defines how users respond to the interface. Users may have different reactions in this interface."(Kevin Silver, 2011)

In reality depending on the nature of the product, some dimensions will get more attention than others, this also applies to the current project. Beginning with words, this dimension refers to the meaning and nature of users' interaction.

There are many things that can be done to this dimension, first the amount of words appearing on the screen at the same time shouldn't make the user feel overwhelmed. This dimension is also a powerful tool for emotional interaction which can be used to boost user engagement.

Visual representation also contributes a lot to the project and sometimes, it can be used to replace the part that demands a lot of words. For example, in the project, instead of using a long description to describe how interesting the location is, we can show the user the advertising map of the resort. Less work, same result.

The next two dimensions, however, don't seem to have much to do in the current project. The physical object of the project is a phone and a smart watch, the only concern for both of them is how to separate the type of information from each other. Time also doesn't have much to improve, except lightly changing the time the information appears to guide user attention.

The last dimension is behaviours and this one is interesting. After all, it seems like a dimension that is influenced by all aspects of the decision. Though between multiple parts of the product, the beginning part is the aspect that contributes most to this dimension. As this part has the following many principles of persuasive design, which aim to increase user engagement.

4 Prototype

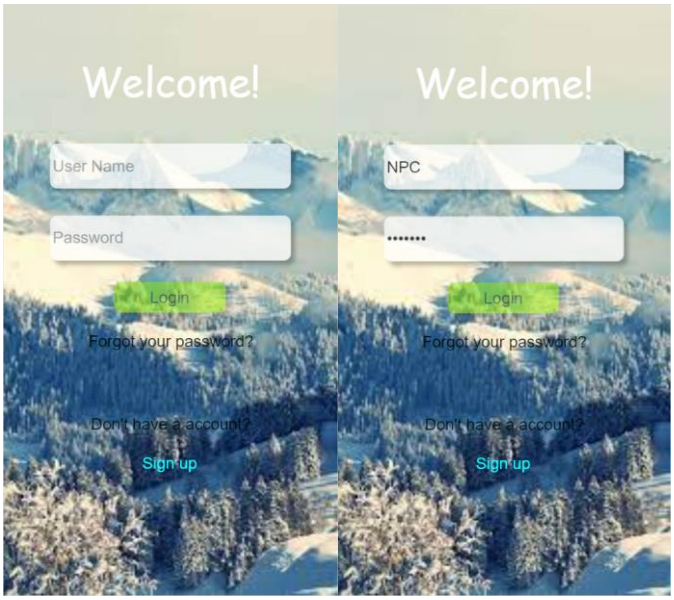
4.1 Tool

To successfully demonstrate the prototype, a good tool is necessary. For this project, the chosen tool is Axure. Some brief information about Axure, "Axure RP Pro / Team is a software for creating prototypes and specifications for websites and applications. It offers drag and drop placement, resizing, and formatting of widgets." (Wikipedia, 2008)

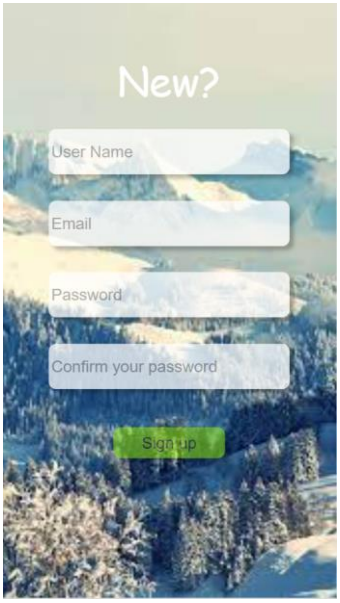
One of the main reasons to choose the Axure is because of its capacity to create a functional prototype. This is vital to demonstrate the interactive aspect of the product, from simple action like button colour change when get touched to a pop up window. Without this, it would be hard to show the interaction design aspect of the project.

4.2 Login

The first step of the experience is login to the app.



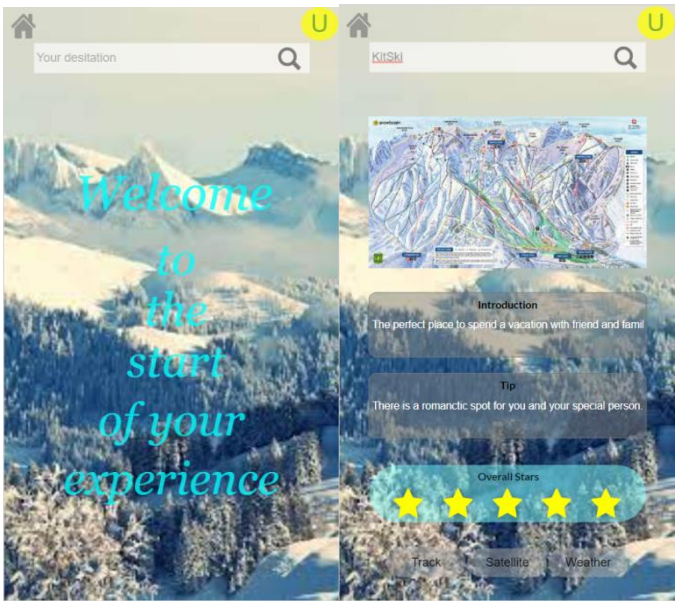
Like any generic login screen, it contains two boxes, one is for users to their name and one for them to input their passwords. Under the login button there is also the option for the user who has forgotten their password and the sign up option for the user.



After doing the sign up, it will return to the login page. After completing the

4.3 Home page

Home page is where it all really begins.



At first there will only be a welcome text, this text doesn't do anything much, but this is actually a form of emotional interaction, which aims to give the user a humanistic feeling. The real information only appears when users search for their destination.

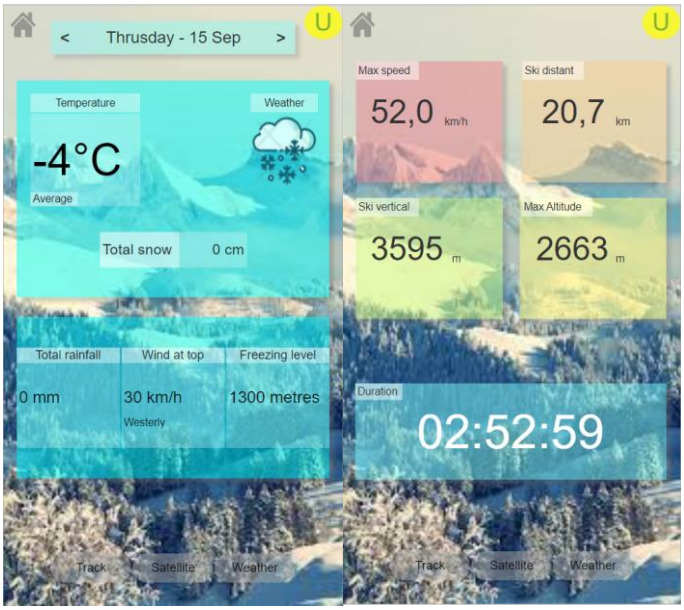
When the user hits the search icon, the information of the ski resort will be displayed. Like mentioned in the concept design, the first part will aim hugely on influencing the user engagement. The first thing that appears is the route map of the ski resort. This aim for two things, allow users to get straight to what they are aiming for, which is about the usability of the product, and give users the first look about what kind of experience they are about to have.

Though the map alone doesn’t make the home page complete its purpose. To show users more than what they can do, is the purpose of the introduction and tip, follow up with the star grading, which is the representation of the persuasive design and emotional interaction.

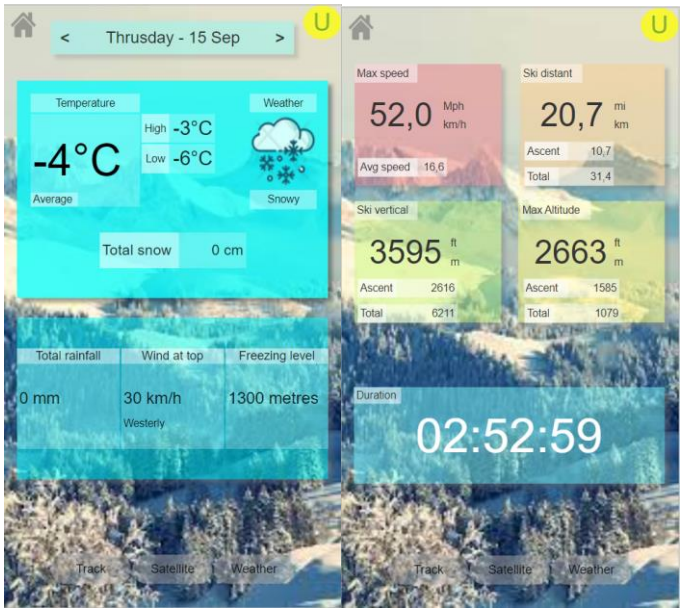
Underline there is also interactive design that aims to improve the visual representation, such as the word being underline and becoming more clear when hovering over.

4.4 Information page

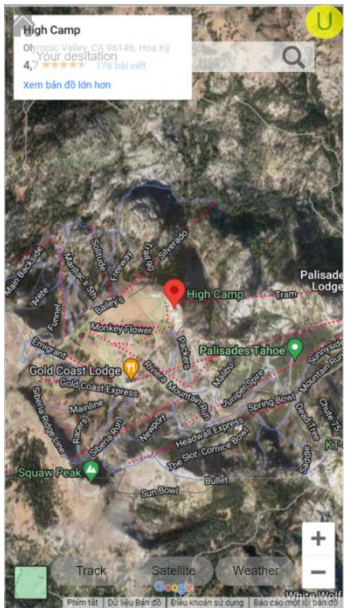
Like mentioned above, the app being more user friendly doesn't mean that it needs to be less professional. And this is one of the ways the two elements can come together.



To make sure that the user doesn't get overwhelmed by the information, when they come to the page, this is what they will see, only the main information. Following the rule of cognition, the design is aimed to let users choose what kind of information they want to focus on, and decree the information they have to see, one of the clearest shows of this is the use of cloud icons to show whether. Of course if users choose too, they can tap into the screen to see the full information.



Lastly, to increase the usability and the conventional element of the application, the product also supports users with the real location of the ski resort on the world map.



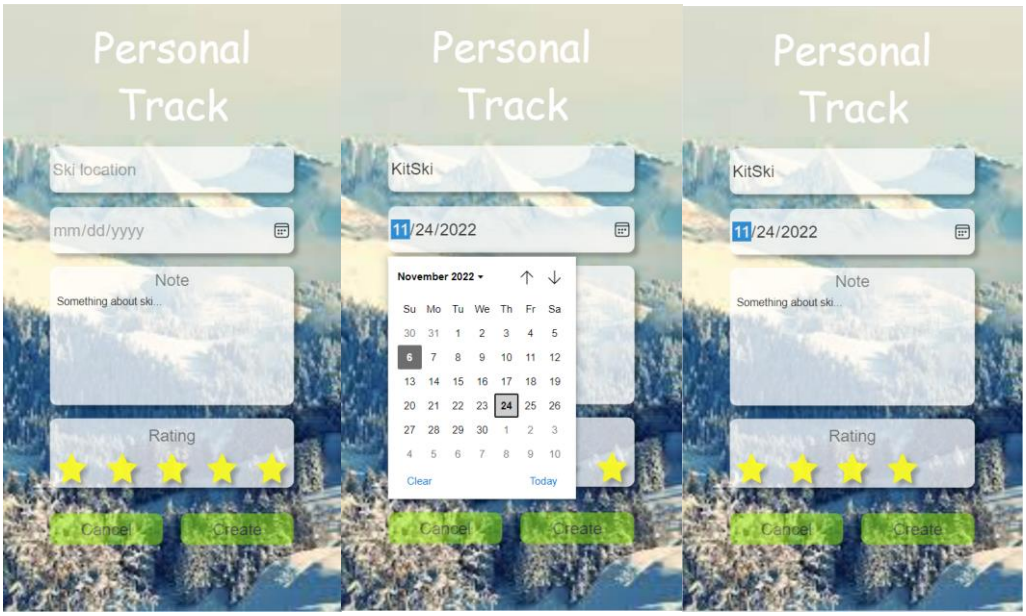
Now that all of the information is already provided to the user let jump to the personal tracking stuff. If we look on top of the screen we can see two icons, one representing a home, which is led back to the home page and the other icon with the U stand for the user. And this icon is the gateway to the user to their personal page.

4.5 Personal track

The moment the icon is clicked, the screen below will appear.

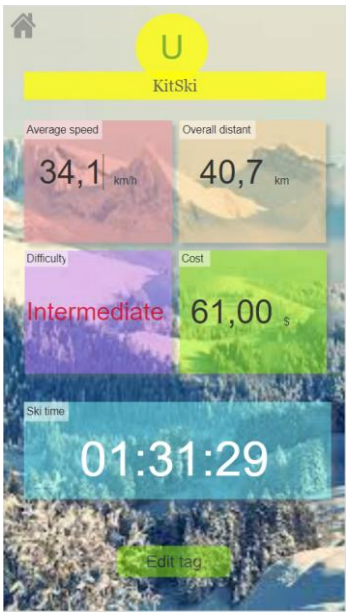
The history page is where the user records their own experience, the record will then be demonstrated in the form of a tag. Following the rule of persuasion, the tag will provide the user with the location name, the date they come to the place, their note and finally their own rating for the place.

There are two main activities that can happen in this place, the first one is creating the tag. To do this all the user needs to do is click on the plus icon.



From this place you can input all kinds of simple information such as the ski resort name, date note, or click on the star to rate the place. The information will then combine with the user to make the overall rating of the place. After doing the information input, the user can click on the create button to confirm the tag or cancel if the user changes their mind.

The second thing happens on the user history, happens when the user clicks on the tag. At that moment the user will be bringed to the personal tracking page.



This is a page where users store their personal experience of the location. Users can input their average speed, overall distance they have gone, cost, the difficulty and of course the time they have skied.

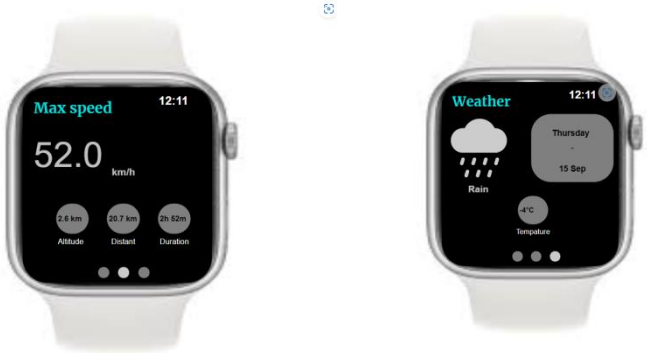
The reason why these elements are chosen is because in theory, this is the type of the information that users can calculate on their own, assuming that they use tracking methods like GPS. With this information, users can have a better picture for their future reference.

After that user can hit the home button to return to the home page or hit the U icon to return to the history page. If the user wishes, they can hit the edit tag option to edit the tag for this page.

4.6 Smart watch application

The smart watch version shares the same vision with the phone version, though because of the nature of the device there are few clear differences.

The first obvious difference is that the watch can't show the same amount of information as the phone. So its design focuses hugely on the cognition and interaction part, which aims to support users with the most likely information that they search for. This can be seen in the two following pages.



Though compared to the phone version, the contribution of icons in this case has increased significantly.

5 Research study

The prototype has come out and it is functional, but it is not yet complete, after all this decision should be made by the user. And this part aims to do just that, collect the answers form users and document them for development aid. But what exactly should we ask the user? How do we know what we ask is sufficient for the core answer at hand?

To understand how this works, first we need to get a brief knowledge about the method used in this case, qualitative and quantitative. These two are one of the most well known research types for user data collection. Quantitative is the method that focuses more on the aspect of answering the clearly defined question, according to Alan Bryman "**Quantitative research** is a research strategy that focuses on quantifying the collection and analysis of data."(Alan Bryman, 2012) Qualitative research, on the other hand, focuses more on the human element, such as thought, idea and emotion, which can't easily be classified.

So to use these two methods to answer the core question, we can break it down into two further types of questions. User overall evaluation of the product and reason behind them.

5.1 Questionnaire

First is the quantitative questions.

Questionnaire	Bad	Neutral	Good
How is the login and sign up functionality?			
How is the environmental data portrayed?			
How is the weather information being portrayed?			
How is the route information being portrayed?			
How is the personal record function?			
How is the information being highlighted?			
How is the interactive element of the app?			
How easy is it to use the app?			
How is your experience?			

As we can see, this questionnaire is used to answer all the functional and nonfunctional requirements of the application. But as mentioned before, this is good to answer the already existing questions, not enough to explain why. And this is where the qualitative question steps in. Though these questions won't follow the same rule as the quantitative.

How do you explain your feeling for the product interaction?

Like the content already makes clear, this question aims to answer how good the interactive element of this product is. But different from its quantitative counterpart, the product aims to capture the information that can help with product improvement.

Is there any part that you feel hard to read or engaged with?

Checking for the effectiveness of the cognitive knowledge implementation is the core of this question. By identifying the part that the user feels is hard to engage, we can check and change products for the better and improve the understanding of the cognitive knowledge.

What is the gap between this ski track application and the one that exists in your mind?

Everyone has a different idea on their mind about how the perfect ski app should work. One of the reasons for this is because different people have different needs. It may be hard to satisfy everyone, but this information is far from useless. By comparing them together, we can catch the needs of the masses and increase the competitiveness of our application in whole.

Is there any information or functionality that you wish for the product to include?

No matter how competent a developer is, there is alway a chance that they can't find a way to satisfy their customer. In this case, asking their customer may be the way out. Though we need to accept that, feasibility does not alway come from the customer's idea, it is still a good material to build upon. Using this question, developers can collect precious material that may bring revolution to their software quality.

Do you feel like coming to the resort after seeing the information?

This question aims to evaluate how much influence does persuasive design have on the user. On the other hand, the answer can possibly contain a way to improve the persuasive element.

5.2 Target audience

Now the method is clear, it is time to consider the target audience. Obviously the best type of user for the ski app is a skier. For location limitations, accessing this group of people won't be easy, but thanks to the internet, developers can access the community with ski interest through social media. And the test doesn't have to be limited to the user.

People with the ski interest also count as the target audience. In fact, they are the perfect tester for how much effect the persuasion design has on the user.

6 Conclusion

Overall, the project is a great opportunity to increase the understanding of Human Computer Interaction. Through this, we have learned how to implement the knowledge of interaction design, cognition and persuasion design. The product comes out to satisfy all the requirements both functional and nonfunctional. Though the experience is far from perfect, and it all comes down to the lack of user participation.

Simply speaking, the app is more for a user than for skiers. This problem can't be solved by just reference the already existing ski app. Only when there is a skier participant, the project can really capture all the needs and build the interaction design that is truly ideal for the skier. This has led to a lot of weakness inside of the app. For example, there is nothing said for sure that the information provided is truly what skiers want to see or whether it is shown in the way they like to see.

Though this isn't necessarily a bad thing, the weakness of the application is also its chance for improvement. Using the set of questions, both qualitative and quantitative, we can get the feedback of users and understand more about what they want to see. Furthermore, we can demonstrate in more desirable ways such as graphs.

Fixing all the weaknesses, however, is not the only way to make the product become more competent. There is also the option of implementing more functions. For the beginning idea, making the application focus more on personalising user experience is a good start. Using AI we can learn about user preferences, potential budget and location, with this information we give them suggestions to ensure both their experience and feasibility for journey.

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